

# **Jetstream-31 (J31) Flight Report for INTEX-ITCT**

## **Flight 8**

**15 July 2004**

Stratus clouds with Ron Brown & Terra, profiles with sondes, tiny clearing with Aqua

### Overview

This was the second J31 flight out of Pease. Goals were:

1. Measure spectra of radiative flux and aerosol optical depth (AOD) above a stratus cloud over the Ron Brown during the Terra overpass
2. Profile with sonde released by Ron Brown, for comparison to J31 meteorological measurements
3. Measure profiles of AOD with radiative flux legs in clear area during Aqua overpass

J31 and the instruments performed very well. We accomplished most objectives. By the time of the Aqua overpass, the clear area seen in morning satellite imagery had become very small, so ability of Aqua to retrieve AOD in this clearing is questionable. Nevertheless, a profile of AOD from ~5 to 0.15 km with Radiative flux legs was obtained, showing layering.

### Clouds, Satellites, and Flight Planning

Cloud predictions and images before flight showed low clouds over the Ron Brown. A clear area around the tip of Cape Cod extended eastward into the Gulf of Maine. The whole Gulf of Maine area was clear of high clouds. Terra and Aqua overpasses were at 1525 and 1705 UT (1125 and 1305 EDT), with acceptable glint and elevation angles in the Western Gulf of Maine

We adopted a plan to fly above the stratus over the Ron Brown during Terra overpass, have Ron Brown release a sonde, profile up with the sonde, and then head for the clear area to profile down to minimum altitude and catch the Aqua overpass.

### Flight Path, Timing, and Measurements

Flight path is shown below. We took off ~1513 UT (1105 EDT). We were flying level above the stratus deck (~2.3 km) near the Ron Brown at Terra overpass (1125 EDT). Stratus reflectivity measured by SSFR was very uniform. Communication with the Ron Brown was very good, and we requested a special sonde release. Brown released the special sonde at 1134 EDT, with an estimated ascent rate of 200 m per minute. At 1148 EDT we started our climb to match the sonde's ascent. We did not see the sonde. We ascended to ~5.7 km, the maximum permitted by flight regulations. We flew a level radiation leg there and headed east to look for the clear area.

We found a small clear area at ~43.1 N, 69.7 W. We profiled down, with radiation legs at ~4 and 3.5 km, chosen on the basis of the AOD profile obtained on ascent over the Brown. At Aqua overpass (1305 EDT) we were at ~150 m in a very small clear area. This descent was close to the regular Ron Brown sonde release time of 1300 EDT, so a second meteorological comparison profile should be possible.

We returned to the Brown and made more measurements above the stratus deck there.

We landed at ~1746 UT (1346 EDT).

### Cloud Remote Sensing and Satellite Validation

Multiple low cloud layers were encountered during the ascent in advance of the 1125 EDT Terra overpass with the lowest at 400 m from the surface and the highest at approximately 2000 m. The objectives were to measure cloud spectral albedo (with SSFR; see attached figure) from which cloud optical depth and effective droplet radius is inferred. AATS-14 measured the aerosol vertical spectral extinction profile from above the highest cloud layer to an altitude of approximately 6000 m. The cloud retrievals and aerosol extinction will aid in validating MODIS cloud retrievals in the presence of aerosol above cloud. For this case cloud optical depth was estimated to be 10 and effective droplet radius between 12-15  $\mu$ m.

The radar and microwave radiometer on the Ron Brown are also used in retrieving droplet effective radius and liquid water path and comparison will be made with the above and below active/passive retrievals. In addition, the profile of aerosol extinction below cloud obtained with the ship lidar, the above cloud extinction measurements, along with the ship and airborne retrievals of cloud water and droplet radii will be used to investigate the indirect effect of aerosols on radiative forcing.

At 1305 EDT the J-31 flew near the surface, to the east of the Ron Brown, in coordination with an Aqua overpass. The objectives were to obtain AATS-14 aerosol spectral optical depths and SSFR ocean surface spectral albedo for MODIS/MISR validation. A variable and broken low cloud layer complicated the radiative field but the sea surface spectral albedo was acquired during this leg, at 150 m above the ocean surface. (See attached figure).

### Instrument Performance

Position and Orientation System (POS): Position accuracy from 6 to <1 m throughout flight, with orientation angles accurate to 0.02 degrees. Got one position reject from the auxiliary GPS, ~1700-1722 UT. In future flights, S turns should be able to relock aux GPS.

Nav/Met: Data displayed by AATS looked good. No data dropouts. Two J31 profiles obtained near Ron Brown sonde profiles should provide good comparison opportunities.

SSFR: Worked well.

AATS: Worked well throughout flight-no evidence of frost. On ground after flight, elevation tracking locked up. Is this related to the tracking problem on Flight 4?

Radar Altimeter: Worked well.

### Lessons Learned

On-plane activities between door closing and takeoff took ~25 minutes and delayed our takeoff from the planned 1045 to 1113 EDT. We need to schedule door closing 30 minutes before takeoff on future flights.



